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DATA PROCESSING 20

COMPUTING

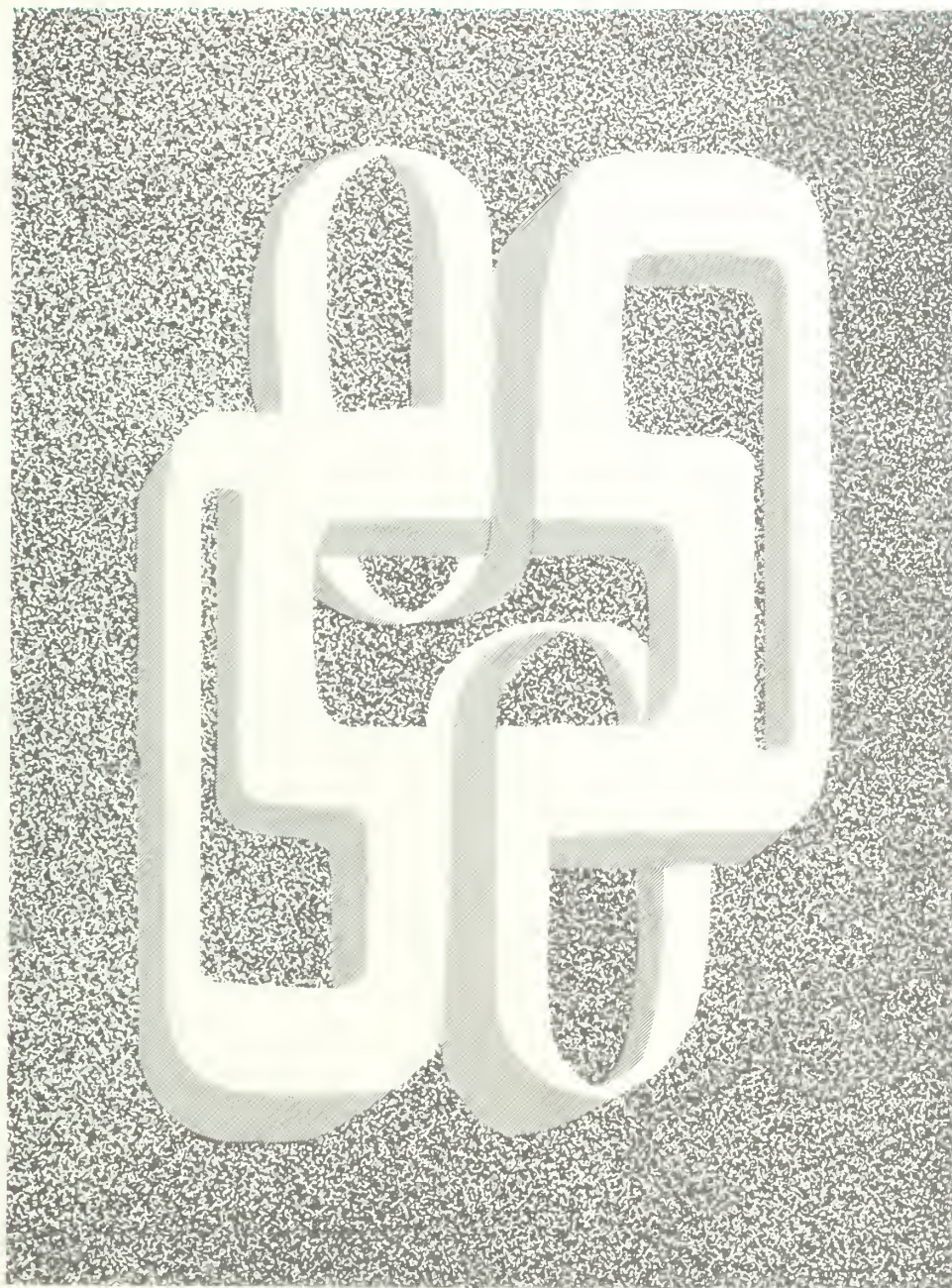
SCIENCE

30

BUSINESS

MACHINES


30



Alberta

EDUCATION

1973



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ACKNOWLEDGEMENT

The Department of Education acknowledges with appreciation and contributions of the members of the Data Processing Ad Hoc Curriculum Committee to the preparation of this Guide.

The Data Processing Ad Hoc Curriculum Committee functioned under the guidance of the Secondary School Business Education Curriculum Committee.

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The department also appreciates the contribution of Kevin Baer, student at Viscount Bennett School, Calgary in preparing the special design used on the front and back covers.

This Guide is a service publication only. The official statement regarding the content of the course is contained in the Senior High School Program of Studies. The information in the Curriculum Guide is prescriptive only insofar as it duplicates the content of the Senior High School Program of Studies. As well as content, the Curriculum Guide contains methods of developing the concepts, suggestions for use of teaching aids and additional reference books.

Teachers of Data Processing, Computing Science and Business Machines should also be familiar with the primary Curriculum Guide for The Business Education Program and Business Foundations 10 and 30.

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I BUSINESS EDUCATION PROGRAM

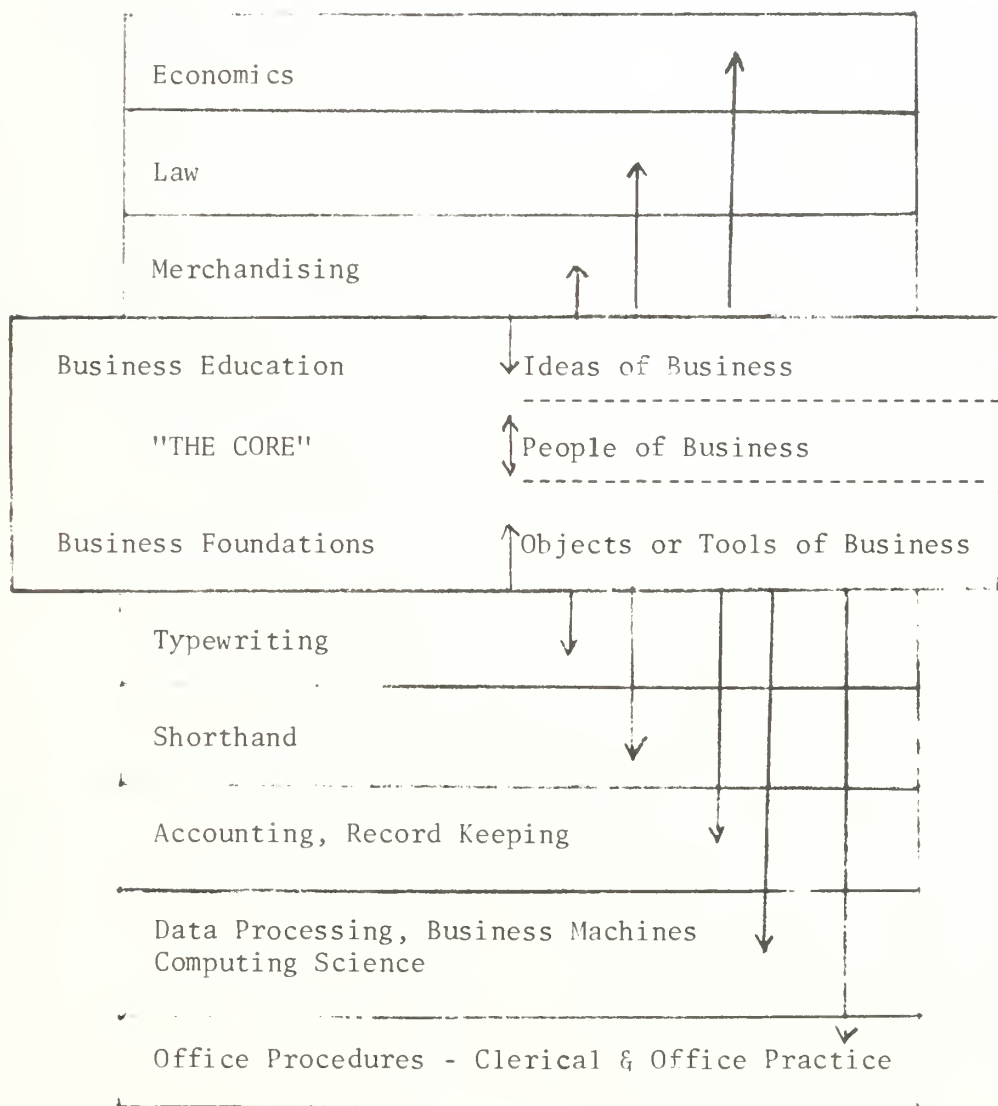
The curriculum for business education has been developed to serve all students in Alberta's secondary schools. Its flexibility permits the selection of one or more courses to complement a program, or the selection of a group of courses to comprise a major area of study. The purpose is to contribute to the general education and to the vocational preparation of high school students.

II GENERAL OBJECTIVES OF ALBERTA BUSINESS EDUCATION PROGRAM

1. To provide a meaningful study of the business environment including the ideas, people, and objects or tools of business.
2. To provide for the development and acquisition of business knowledge and skills which will be most useful and durable in a rapidly changing society.
3. To provide an opportunity for students to elect and pursue individual interests and specialization in the study of the business environment.
4. To provide for individual development in the behaviours of thinking, acting and feeling.
5. To develop the thinking strategies and problem-solving abilities of students.
6. To provide an opportunity for students to relate and apply learnings in business education and other areas of study.
7. To expose students to the vast laboratory of business for the purpose of acquiring information, gaining experience and testing ideas and hypotheses.

From the conceptual model explained in the Curriculum Guide for The Business Education Program and Business Foundations 10 and 30, and the preceding Objectives of the Alberta Business Education Program, the following blueprint was developed. It shows the relationship of the various subjects. Business foundations is the core of the program. Some subjects emphasize the ideas of business; others emphasize the objects or tools. People in business is the unifying aspect in all subjects relating the ideas with the objects and tools of business.

Blueprint Of The Business Education Program

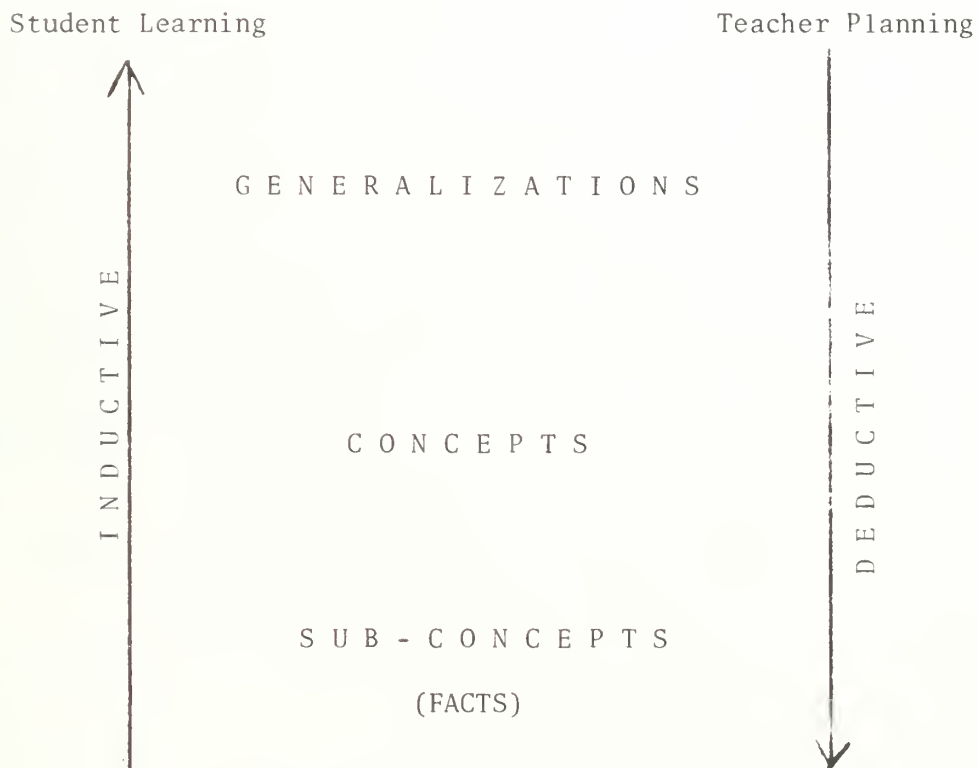


III CURRICULUM DEVELOPMENT

Content in Business Education courses is organized around the following elements, concepts, sub-concepts and generalizations. Curriculum guides provide additional suggestions under the following components: behavioural objectives, teaching strategies and evaluation.

Curriculum committees, when organizing a body of knowledge, use either the inductive or deductive method. The diagram below may help to explain the relation that exists between the elements of a body of knowledge.

CURRICULUM DEVELOPMENT



Facts and sub-concepts are taken to be items of specific information concepts are categories of information and generalizations express the relationship between concepts. In planning a lesson, the teacher moves down this hierarchy whereas in learning, the student begins with the facts and moves upward.

The deductive approach was used in developing the course outlines for Data Processing 20 and Computing Science 30.

IV INTRODUCTION TO DATA PROCESSING AND COMPUTING SCIENCE

It is increasingly important that every student acquire at least a basic knowledge of the computer, if only to remove some of the mystery which many people attribute to it. The computer and its systems are now common in many aspects of modern life, from banking to credit buying and space technology. An understanding of both the capabilities and the limitations of electronic computers is becoming invaluable.

The knowledge necessary to appreciate its capabilities and limitations can be acquired at different levels to meet the different needs - from basic understanding of the fundamental principles in processing data by mechanical and electronic means through to understanding of the intricacies of programming and systems design and the sophisticated techniques that may be used in each of these.

The data processing program comprises two courses of instruction - Data Processing 20 and Computing Science 30. Data Processing 20 can be taught for three or five credits and Computing Science 30 for five credits. Data Processing 20 is a general course of interest to all students in order to develop an appreciation of the significance of data processing in every day life and its offering is in no way dependent upon the availability of equipment. In Computing Science 30, emphasis is given to the programming of business, science and mathematics applications and to systems design. The offering of this course in Alberta schools is dependent upon the **availability** of computer time and equipment to prepare input data. Furthermore, the type of computer language used is dependent upon the capabilities of computers available to individual schools. Data processing 20 is not necessarily a prerequisite to Computing Science 30.

V. GENERAL OBJECTIVES OF DATA PROCESSING AND COMPUTING SCIENCE

1. To promote an understanding of the fundamental principles in processing data by manual, mechanical and electronic means.
2. To provide a vehicle for developing further the thought processes of analysis, synthesis and problem-solving.
3. To present basic principles of logic which have eventual application in many decision making situations.
4. To develop knowledge and skills in the general field of computing science.
5. To provide an understanding and appreciation of the interaction and the interdependence of man and machine.

6. To provide opportunities for students to develop effective interaction among individuals as members of a team processing information.
7. To encourage student initiative, freedom of thought, and adaptability as preparation for future changes and developments in data processing.
8. To provide an introduction to data processing equipment and techniques as a broad base upon which the student may evaluate a possible career in this field.

VI. DATA PROCESSING 20 (3 or 5 credits)

This is a general course of interest to all students in order to develop an appreciation of the significance of data processing in every day life and its offering is in no way dependent upon the availability of data processing equipment.

A. Scope

Five credits: Detailed coverage of the course outline.

Three credits: Coverage of the course outline in less detail.

B. Primary Reference

Wanous and Wagner, *Fundamentals of Data Processing*, Gage Educational Publishing Limited, 1971.

Support Materials.

Teacher's Manual (J50M) to accompany the above text.

Student Project Kit (J501)

C. Course Outline for Data Processing 20

Generalization I: Needs for data processing exist in various situations.

| Concepts & Sub Concepts | Specific Objectives | Suggested Activities and Resources |
|----------------------------|---------------------|---------------------------------------|
|----------------------------|---------------------|---------------------------------------|

NOTE: the transparencies referred to in all generalizations are: Lagenbach, R.G. Introduction to Data Processing Transparencies. Gage Educational Publish.Limited, Agincourt, Ont.

The student should be able to:

- A. Data processing Business Scientific Government
- define data processing
 - recognize the historical perspectives of the modern concept of data processing.

- Transparencies 1 - 5.

- Have students bring examples of media that illustrate the presence of business data processing. Such items as utility bills, form letters personal cheques, or pay stubs would be suitable.

- Discuss, with students, the existence of data processing as found in familiar situations such as in the school, part-time jobs or store purchases.

- Encourage the student to be on the lookout for newspaper and magazine articles on the subject of data processing as a basis for further classroom discussion.

- Display this poster series on the wall, "Posters on Mathematical Machines", (J. Weston Walch, Publisher, Portland, Maine).

Generalization II: Within Data Processing there is a series of operations

| Concepts & Sub-Concepts | Specific Objectives | Suggested Activities and Resources |
|--|---|---|
| A. Data processing functions (operations) Recording Classifying Sorting Calculating Communicating Storing | <p>The student should be able to:</p> <ol style="list-style-type: none"> define the functions of data processing. relate the functions to a variety of situations. demonstrate and detect the use of functions in every day life activities. | <p>Transparency 6</p> <ol style="list-style-type: none"> Discuss, through case examples the presence of a data processing cycle. Develop a glossary of the terms that arise out of the data processing cycle. Illustrate each of the operations in the data processing cycle with such activities as: <ol style="list-style-type: none"> Classifying--have the students classify themselves in as many ways as possible. (e.g. grade, sex, etc.) Sorting--have the students sequence numeric and alphabetic data. |

Generalization III: Data processing is carried out in a variety of methods.

| Concepts & Sub-Concepts | Specific Objectives | Suggested Activities and Resources. |
|---|---|---|
| A. Methods of data processing Manual Electromechanical Computer. | The student should be able to: a. identify the methods of handling information. b. classify equipment according to the method it serves. c. assess each method as it re- lates to individual applica- tions. | Transparencies 5, 12-18 Illustrate and discuss examples of data processing devices as they relate to the various methods of handling data. Examples might be such devices as the pegboard, keysort, calculating machines, duplicating equipment. Discuss the rationale behind the selection of a method of handling data. |

Generalization IV: A basic medium of information processing is the punch card.

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|--|---|--|
| A. Physical characteristics of a card. | The student should be able to: | a. Transparencies 22, 23, 49 |
| Dimensions | a. define the physical characteristics of a card. | b. Have students decode a message on a pre-punched Hollerith card. |
| Edges | b. identify the physical structure of a card. | c. Have students apply the Hollerith code by simulating the punching of a message by pencil shading. |
| Rows | c. demonstrate an understanding of the Hollerith Code. | d. View the film or video tape, "Data Processing-- Introductory Principles" (MEETA) |
| Columns | d. recognize the versatility of the Hollerith Code and its application. | e. Using familiar source documents such as student registrations, invoices or customer statements, have students design appropriate card lay-outs. |
| Corner Cuts | e. plan the arrangement of data on a punched card from a source document. | f. Encourage the students to bring to class samples of punched cards from their home or business sources. |
| Color | f. recognize the various applications of the punched card. | |
| B. Representation of data | | |
| Hollerith Code | | |
| C. Card planning and lay-out | | |
| Field and subfields | | |
| Principles of card design | | |
| D. Card application | | |

Generalization V: There are many processes and machines for handling punched card information:

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|---|--|---|
| A. Recording and verifying Mark sensing Port-a-punch Keypunch | The student should be able to: a. define the varied processes involved in handling punched card information. | a. Transparencies 19 - 21, b. If equipment is available, demonstrate and have the students produce a number of cards themselves. |
| B. Sorting and collating Numeric Alphabetic Report Sorting Sorting for selection Merging Matching | b. recognize the varied processes involved in handling punched card information. c. identify examples of punched card equipment and relate them to their functions. | c. Simulate the sorting and collating processes through the use of black-board diagrams. d. Demonstrate the operation of unit record equipment if it is available. |
| C. Calculating | | |
| D. Reporting | | |

Generalization VI: Any computer system is made-up of a number of basic components.

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|------------------------------|--|--|
| A. Computer types | The student should be able to: | a. Transparencies 50-52, 56-79 |
| Digital | a. define analog, digital and hybrid as the terms relate to computer types. | b. Have students read and discuss magazine articles such as "Behold the Computer Revolution" (National Geographic, Nov., 1970) |
| Analog | b. recognize the unique characteristics of computer system. | |
| Hybrid | | |
| B. Input | | c. Students might write a term paper on some aspect of the computer. |
| Direct entry into storage | c. examine the various means by which information can be communicated to a computer. | |
| Card reader | | |
| Magnetic tape devices | d. define the central processing unit and its components. | d. Introduce students to computer numbering systems through encoding and decoding exercises. |
| Paper tape devices | | Data manipulation (addition, subtraction, multiplication and division) could be attempted. |
| Optical character readers | e. distinguish between primary and auxiliary storage. | |
| Magnetic ink readers | | |
| Disks | f. demonstrate an understanding of computer numbering system(s). | e. Have the students read and discuss "How the Computer Gets the Answer" (Life Educational Reprint #33. Originally printed in Life, November 27, 1967) |
| C. Central processing unit | g. examine the various means by which information can be reported by a computer. | |
| Memory or storage | | |
| Arithmetic and logic Control | h. to classify computers into different sizes as determined by central processing unit, speed of processing, number of peripheral devices and the speed of the peripheral devices. | f. Show the film "The Thinking Machine". (Available from Alberta Government Telephones) |
| D. Output | | |
| Printers | | |
| Card Punch | | |
| Paper tape punch | | |
| Magnetic tape units | | |
| Magnetic disk | | |
| Graphic plotters | | |
| Visual display devices | | |
| Audio response units | | |

Generalization VII: Problem solving by a computer consists of a number of tasks.

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|--|---|--|
| A. Programming Problem definition Flowcharting Coding of instructions Testing of documentation | <p>The student should be able to:</p> <ol style="list-style-type: none"> examine a representative sample of the applications of the computer. break down a problem into a logical developmental sequence of events. recognize that performance of a computer is dependent upon a detailed set of instructions based on a logical sequence of events. | <ol style="list-style-type: none"> Transparencies 95 - 100 Illustrate computer processing through student role playing. One student outlines instructions (program) for some simple activity (opening a window, moving from one spot to another) while another student performs these instructions as if he were a computer. Illustrate the use of a flowchart as a tool for logical sequencing of events. Have the students flowchart the solution to an assortment of problems. Illustrate the preparation and execution of simple programs through the use of CARDIAC. Students might be introduced to a compiler level programming language with a view to writing an actual program(s). Arrange a field trip to a computer installation. |

N. B. --- Depending upon the time and resources available to a teacher, a decision should be made regarding the depth to which the above topic may be explored.

Generalization VIII: The application of the computer in our society is varied.

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|-------------------------|---|---|
| A. Business | The student should be able to: a. examine a representative sample of the applications of the computer. | a. Transparencies 95 - 100 |
| B. Government | | b. Have the students research an actual application of a computer (term paper). |
| C. Science | | |

Generalization IX: Information processing involves an interdependence of man and machine.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|---------------------------|---|--|
| A. Systems and Procedures | The student should be able to: a. define systems and procedures as the terms relate to information processing. b. recognize that there is a balance of man and machine regardless of the type of system employed. | a. Discuss systems and procedures as it relates to some previously discussed or researched applications. |

SUGGESTED EVALUATION

Evaluation is an essential part of the learning process for the student and a necessary form of feedback for the teacher. The possible techniques of evaluation are many and varied; and must be applied with a view to the level of competence that can be reasonably expected based on the make-up of the class.

Techniques which might be considered include the following:

1. Projects from the Student Project Kit for Fundamentals of Data Processing
2. Study Guides for Fundamentals of Data Processing
3. Teacher prepared objective texts
4. Teacher prepared simulation projects
5. Student research projects such as term papers
6. Student participation in classroom discussions
7. Student written programs

C O M P U T I N G S C I E N C E 3 0 (5 credits)

The teaching of Computing Science 30 is dependent upon the availability of computer time and equipment to prepare input (programs and data). Before the decision is reached to offer this course, application should be made to the Curriculum Branch, Department of Education, indicating that:

1. A qualified teacher is on staff to teach the course.
2. Equipment needed to prepare student programs and data is available in the school, or has been approved for a new school by the School Buildings Board, Department of Education.
3. Computer time is available. The Curriculum Branch, Department of Education, will make arrangements for computer time at the Northern and Southern Alberta Institutes of Technology, or local authorities may make arrangements with other data centres.

A. Scope

Detailed coverage of the course outline.

B. Primary References

Feingold, *Introduction to Data Processing*, Wm. C. Brown Co., Canadian agent, Burns and MacEachern Ltd., Don Mills, Ontario, 1971.

Support Materials

Teacher's Manual and Student's Workbook to accompany the above text.

OR

Awad, *Business Data Processing*, Prentice-Hall of Canada, Ltd. Scarborough, Ontario, 3rd edition, 1971.

Support Materials

Teacher's Manual and Student's Workbook to accompany the above text.

Generalization I: There are many basic data processing principles.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|--|---|--|
| A. Data Processing Problem definition Logical sequencing of events | The student should be able to: a. recognize the existence of a problem and be able to state the problem clearly. b. analyze a problem as to its logical developmental sequence of events. c. convert from the process solving sequence to the electronic data processing cycle. (system) | 1. Discussion and presentation of: a. the logical sequence (method of general problem solving). b. the applications of the problem solving technique. c. the special emphasis on problem definition. d. simulations of every day decision making activities. |
| | | 2. Students should graphically illustrate the usual sequencing of events and decision making in arriving at a final solution. |
| | | 3. Place emphasis on conversion to electronic data processing cycle from general problem solving. |

Generalization II: Any computer system is made up of a number of basic elements.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|------------------------------|---|---|
| A. Input Unit | The student should be able to: | 1. Discussion and presentation of: |
| B. Output Unit | a. recognize the existence of a computer system. | a. electronic data processing cycle. |
| C. Central Processing Unit | b. integrate the relationship of the elements of a computer system. | b. function of individual segments of a computer system. |
| Memory | | c. integration of sections into a total computer system. |
| Arithmetic and Logic Control | | 2. Elicit from students verbal or written responses of perception of a computer system. |
| | | 3. Student reports and resultant generated discussion of segments of system and/or total computer system. |
| | | 4. Readings in text and use of support materials (student workbook). |
| | | 5. Presentation of and ensuing discussion of films from industry. |
| | | 6. Possible use of programmed lessons from Honeywell and/or I.B.M. |
| | | 7. Use of transparencies from 3M or Gage. |

Generalization III: A Computer system may incorporate many and varied hardware devices.

| Concepts & Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|--|---|---|
| <p>A. Input/Output</p> <ul style="list-style-type: none"> Card Card punch Magnetic disk Key to tape unit Magnetic drum Direct access terminal Paper tape reader Paper tape punch Line printer Magnetic ink character reader Optical character reader Visual display terminal Graphic plotter Audio response unit | <p>The student should be able to:</p> <ul style="list-style-type: none"> a. examine the various means by which information can be communicated to and from a computer. b. identify the means by which information is stored. c. examine commonly used memory devices. d. distinguish between primary and auxiliary memory. e. demonstrate a knowledge of internal data representation. | <ul style="list-style-type: none"> 1. Discussion and presentation of introductory I/O features. 2. Students report on the introductory I/O features. 3. Guest lecturer from computer supply companies or users in industry. (via Canadian Information Processing Society "local chapter" or Data Processing Management Association "Local chapter"). |
| <p>B. Primary memory</p> <ul style="list-style-type: none"> Magnetic Cord Thin film Rod | | <ul style="list-style-type: none"> 4. Instructions and demonstrations on using equipment students will be involved with later in the course. 5. Transparencies (3M, Gage). 6. Films (Motion). 7. Film strips. |
| <p>C. Auxiliary Memory</p> <ul style="list-style-type: none"> Magnetic disk Magnetic drum Data cell Magnetic tape | | <ul style="list-style-type: none"> 8. Field Trip or work-study project for students and teacher. 9. Discussion and presentation of the interrelation of price, capacity and speed as it relates to the task to be performed. 10. Define concept of buffering as it relates to efficient hardware utilization. |

Generalization IV: The functioning of a computer system is dependent upon a number of software factors.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|------------------------------|--|---|
| A. Machine language | The student should be able to: a. understand the interrelationship of various levels of software to the functioning of a computer system. b. operate within the system commands. | 1. Discussion and presentation of reason for and use of machine language. |
| B. Compiler or assembler | | 2. Use of A.G.T.'s CARDIAC. |
| C. User program language | | 3. Discussion and presentation of the concept of programming languages-compiler or translator and/or assembler language concepts. |
| D. Operating system commands | | 4. Instruction and demonstration of the operating system the students will use with emphasis upon system commands and JCL (optional). |
| | | 5. If use of interactive system is available allow students time to play simulations and games on the system. |

Generalization V: Computer users must provide a system with a program in order to solve a problem.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|---|--|---|
| A. Basic computer instructions: Input/Output Arithmetic Decisions Looping Lists and arrays | The student should be able to: a. demonstrate an understanding of basic computer instruction for the selected languages. b. design input and output in appropriate form. | 1. Present, and demonstrate using simple programs, the basic concepts in programming. 2. Students should write and run their own sample programs after each programming instruction or technique. |
| B. Programming techniques - Data formatting - Flowcharting - Coding in programming language - Documentation | c. organize and construct a flowchart to show the problem solution in graphic form. d. convert a flowchart to machine acceptable form. e. assess and correct logic and syntax errors. f. document the program and assess its results. | 3. Have as many developmental programs available as possible for the students perusal and discussion. 4. Allow the students as much individual freedom as possible. |
| C. Systems and Procedures | g. apply basic programming conventions to a variety of applications. h. recognize the relationship between the program and a total data processing system. | 5. Discuss error diagnostics for the system being used. 6. Keep "turn-around time" as short as possible. 7. Emphasis might be placed on: a. logic and program development. b. program efficiency. |

Generalization VI: The field of computing technology is rapidly expanding and developing in our society.

| Concepts and Sub-concepts | Specific Objectives | Suggested Activities and Resources |
|---|---|--|
| A. Impact of change in the computing field. | The student should be able to: | 1. Class discussion. |
| B. Impact of change on society. | a. evaluate the present situation and involve himself in future changes and developments. | 2. Student reports on future needs and developments. |
| | | 3. Films. |
| | | 4. Field trips. |
| | | 5. Guest speaker. |
| | | 6. T.V. programs (Here Come the 70's etc.). |
| | | 7. 2001: A Space Odyssey. |
| | | 8. Use and introduction of Trade periodicals such as DPMA'S "Data Management" etc. |
| | | 9. Poster series could be used. |
| | | 10. Create career guidance in the field of data processing and computing science. |

SUGGESTED EVALUATION

Because of different levels of aptitude and ability, all students will not remain at the same level of growth. Therefore, individualization of program assignment and work load must take into account these individual differences.

Formal evaluations might be based upon:

- student reports (perhaps oral presentations)
- objective tests prepared by the teacher
- programs done by students (a large portion in any evaluation)
- use of materials in the student workbook
- use of "open-book" exams where the writing of a program or programs is involved.

In the above formal evaluation syntax of the user language should be considered of lesser importance when compared to the logic of problem solving and the program efficiency (ie. economy of CPU time and storage space).

The above evaluation suggestions should not only enable a fair examination of student progress but also of the teacher's self-evaluation of his or her effectiveness in the learning process.

SECONDARY REFERENCES

A. Books

Abrams, Peter and Walter Corvine, *Basic Data Processing*, 2nd Edition, Toronto: Holt, Rinehart and Winston, Canada, 1971.

This book is best suited as a reference at the Computing Science 30 level. However, it could serve as enrichment for the advanced Data Processing 20 students. Topics dealt with include: Problem Analysis and Flowcharting, System Analysis and Design; and Fortran, COBOL, and PL/I programming.

Adams, J. M., and R. Moon, *An Introduction to Computer Science*, Toronto: Gage Educational Publishing Co., 1970.

This excellent book could serve both as a teacher reference and student text for units 3 and 4 in Computing Science 30. It includes such concepts as FORTRAN notation, input/output statements, go to, loops, dimension and do. This text is almost entirely devoted to the FORTRAN Language.

Bernstein, J., *The Analytical Engine: Computers -- Past, Present and Future Vintage*, Toronto: Random House 1964.

This book should be used to provide the student with interesting reading material on such areas as history and present computer uses and capabilities as well as some of the less common uses of computers.

Bushnell, D. D., and D. W. Allen, *The Computer in American Education*, Rexdale, Ontario. John Wiley, 1968.

A collection of articles that describe how computers and education can be related. The main sections are: individualized instruction and social goals, computers in instruction and research, teaching the Computer Sciences information processing for education systems. An excellent book for teacher reference for Data Processing 20 and Computing Science 30.

Campbell, Robert, *How the Computer Gets the Answer*, Life Educational Reprint No. 3, Nov. 27, 1967, Life Educational Reprint Program, Radio City, New York.

Coan, James S., *Basic Basic An Introduction to Computer Programming in BASIC Language*, Don Mills, Ontario. General Publishing

de Ferranti, Basil, *Living with the Computer*, Don Mills, Ontario. Oxford University Press, 1971.

An excellent reference for discussion of the impact of the computer in society. This book covers such areas as the use of the computer in the home, research, education, law, government, health, and business and industry. The teacher might draw upon this source for unique examples of computer use.

Dippel and House, *Information Systems: Data Processing and Evaluation*, Agincourt, Ontario: Gage, 1969.

With the possible exception of the better Computing Science 30 student, the value of this book as a student reference is probably somewhat limited. However, it can serve to provide valuable background information for the teacher. Emphasis is on information handling rather than programming.

Fletcher, Cashman, I. B. M. *System 360 RPG Programming Vol. 1 Introduction*, Anaheim Publishing Company, 1970.

Although there are two volumes available, volume one is of sufficient depth for Computing Science 30. The book is well illustrated. As such, it is relatively easy to follow the presentation of the language. Questions and sample problems are included to help the student in the learning of the language. This book might well be considered a combination text and workbook.

Hull, Thomas E. and David D. F. Day, *Computers and Problem Solving*, Addison-Wesley Canada Ltd., 1970.

This book is designed to be used in conjunction with any Computing Science Course although it emphasizes FORTRAN. The authors outline over thirty-five projects and programs to be given to the student. Each is discussed in great detail to help the student and/or teacher. The book contains an excellent appendix on reference materials as well as a documented index and answers to selected questions in the book.

Jones, Robert L., and Oliver Gail, *Basic Logic for Program Flowcharting and Table Search*, Anaheim, California, Anaheim Publishing Company, 1968.

This book partly compensates for the lack of available material on flowcharting and development of program logic present in most general texts. The book uses simple examples and illustrated charts followed by remarks. Excellent supplemental material for Computing Science 30.

Kemeny, John G., and Thomas E. Kurtz, *Basic Programming*, Rexdale, Ontario. John Wiley, 1967.

This book though not new provides one of the most excellent introductions to BASIC programming in Computing Science 30. There are many varied applications used to develop the BASIC language concepts.

LaFave, Milbrandt, and Garth, *Problem Solving -- The Computer Approach*, Scarborough, Ontario, McGraw-Hill, Ryerson Limited, 1972.

This text provides some excellent ideas for the teacher in presenting the correct problem solving techniques. It incorporates articles from periodicals and student exercises into the text.

Laurie, Edward J., *Modern Computer Concepts*, Agincourt, Ontario. Gage, 1970.

This is a very good reference at the Computing Science 30 level. In addition, there is a Teacher's Manual to accompany the text which contains teaching suggestions, suggested class activities, and suggested examination questions. The text is geared to the I.B.M. System 360 and along with basic introductory material includes sections on the I.B.M. 360 Assembler, Fortran IV, COBOL, RPG, PL/1, and Basic Programming Languages.

Lott, Richard W., *Basic Data Processing*, (Second Edition), Scarborough, Ontario, 1971.

The best description offered for this book would be it's title, "Basic Data Processing". The book is most definitely a theoretical approach with little hands on, or practical experience in dealing with a computer. Not recommended for student use, but a good teacher reference where high caliber business students are involved. Would serve well as a library reference book within the school library.

Mullish, H., *Modern Programming: FORTRAN IV*, Toronto, Ginn-Blaisdel, 1968.

This book is an excellent source of ideas for student problems. As well as presenting sample problems with problems that might be encountered, the book presents basic FORTRAN instructions.

Pavlovich, P., and Thomas E. Tahan, *Computer Programming in Basic*, Holden-Day Incorporated, 1971.

This book presents one of the most thorough treatments of BASIC seen. It would serve as an ideal reference book for an introductory computing science course for students who have had a traditional mathematical background. "The problems presented in this book are mainly mathematical in nature, and are directed towards students with varying degrees of mathematical background . . ." Materials and projects are presented in a logical manner from simple beginning problems leading to more difficult problems which necessitate the use of a computer with a larger core.

Randall, Clarence B., and Sally Mcimer Burgley, *Systems and Procedures for Business Data Processing*, (2nd Edition), Agincourt, Ontario. Gage, 1968.

This book along with its accompanying lab problems and teacher manuals is designed for the well versed business education student or for a student having some experience in the business world. It is highly informative and is divided as follows: system fundamentals; data processing equipment; techniques for system and data processing applications; and business procedures and procedure applications. The section dealing with techniques supplies excellent coverage of charting, methods of coding and condensing data as well as card and forms design. It contains a realistic and practical source of information in the field of data processing.

Walsh, Mandel, and Matthias, *FORTRAN IV: Programming and Problem Solving*, Toronto; Pitman, 1972.

This text could be used for enrichment or for students needing extra help. There are sample problems and student exercises. In addition to basic FORTRAN programming, the text includes a chapter on input/output devices that could be used for Generalizations II and III Computing Science 30.

Wanous, Wanous and Hughes, *Introduction to Automated Data Processing*, Practice Set, Agincourt, Ontario. Gage, 1968.

This is a good supplemental package for Data Processing 20 students, although it is somewhat dated. It consists of a series of small projects based on the theory presented in the accompanying text.

Wendel and Williams, *Introduction to Data Processing and COBOL*, Scarborough, Ontario. McGraw-Hill Ryerson Limited, 1969.

This is a very good reference for the teacher using the COBOL Language in the classroom. After introducing the reader to some basic concepts in data processing, the basic structure of the COBOL Language is outlined. Some additional features of the language are also dealt with. An appendix provides a summary of COBOL rules and reserved words.

White, Peter, T. *Behold the Computer Revolution*, National Geographic. Vol. 138, No. 5, November 1970, Washington, D. C., National Geographic Society.

An excellent article, simply written on the wide variety and uses of the computer in such areas as Sim-One -- a computer-manikin for training medical students; crime detection; archeological research; job placement, robots, fashion trends, computer art, defence, population trends and music. The illustrations and photographs should stimulate student interest in this area.

B. Films

The following is a list of the motion picture films of I.B.M. Canada Ltd. which are directly available to the public.

No film rental or service charge is made for the use of these films. The exhibitor pays only for insurance and return postage.

To order a film write the film distributor in care of:

Modern Talking Picture Service, Inc.
1875 Leslie Street
DON MILLS, Ontario

Or

I.B.M. Canadian Film Library
c/o Association Visual Service Ltd.
1590 - West - 4th Avenue
VANCOUVER, British Columbia

- #6423 - A Better World (influence of computers in our daily lives) Color, 8 minutes, 16mm.
- #6749 - A Computer Glossary (defines basic terms and describes circuitry) Color, 14 minutes, 16mm.
- #6743 - Adventure in Space (story of the flight of Gemini 8 and ground control) Color 14 minutes, 16mm.
- #6742 - Flight Simulation (the use of digital computers in solving complex simulation problems) Color, 20 minutes, 16mm.
- #6450 - How to Succeed at Cards (the manufacture of I.B.M. cards) Color, 12½ minutes, 16mm.
- #6621 - I.B.M. at Expo (I.B.M. exhibits - voice recognition, C.A.I., Light beam trans.) Color 13 minutes, 16mm.
- #6455 - The Information Explosion (the computers role in today's society) Color 21 minutes, 16mm.
- #6456 - The Information Machine (the development of the computer starting at primitive man) Color, 10 minutes, 16mm.
- #6634 - Man and Computer as a Perspective (a primer on basic elements of data processing) Color, 20 minutes, 16mm.
- #6753 - Man and Computer Today (impact of computer on modern world) Color, 11 minutes, 16mm.

- #6472 - Once Upon a Punched Card (basic principles of punched card accounting) Color, 9 minutes, 16 mm.
- #6492 - Small Miracle (the computer applied to various disciplines) Color, 14 minutes, 16mm.
- #6602 - Universe of Numbers (history of computer development) B. & W., 30 minutes, 16mm.

This is a partial list but a complete catalogue may be obtained from the sources listed above.

The Thinking Machine, AGT - Customer Relations

Super 8mm Filmloops, AGT - Customer Relations:

- Binary Numbers
- Computer Flowcharts
- Information Processing
- Input/Output
- Memory Devices

** More Cards ... Less Time - Univac

** Time, Tempo and Money - Univac

** The New World of the 9400 - Univac

Introduction to Digital Computers - Univac

The World of Real Time - Univac

The World of Number - NCR

The On-Line Story - NCR

The Living Machine - National Film Board

Super 8mm Filmloops: Department of Extension, University of Alberta

- Around Perception
- The Computer Revolution
- Computers and the Mind of Man (series)
- Computers and Human Behaviour
- Computers: Pattern, Purpose and Prospect
- The Living Machine (parts I and II)
- Sign On -- Sign Off
- This Automation Age
- Digital Computer Technique (series)
- The Electronic Computer in Commerce
- Glossary

Data Processing Sound Filmstrips, 1972 - Gage Educational Publishing Limited.

** Sales Oriented

Descriptive Materials & Literature

Posters - J. Weston Walch, Publisher, Portland , Maine

Mathematical Machines (historical development of data processing tools)

Computers

Computers in Occupations

Transparencies - Introduction to Data Processing, R. G. Langenbach
Gage Publishing Limited

Introduction to Data Processing, 3M Company, 1966.

Introduction to Computers, GAF Corporation; 140 West
51 Street; New York, N. Y. 10020

Business Data Processing, McGraw-Hill-Ryerson, (84324-1)

Computer Simulation - CARDIAC: Alberta Government Telephones;
Customer Relations; Edmonton, Alberta

Cards & Business Form Samples - I.B.M. Card Plant; Local business
firms using computer processing.

Life - Educational Reprint #33, How the Computer Gets the Answer,
November 27, 1967; Life Educational Reprint Program;
Box 834; Radio City Post Office; New York, N.Y. 10019

National Geographic - Behold the Computer Revolution, November, 1970,
National Geographic Society; Washington, D. C.

Reader's Digest - Census '71: Portrait of Canada, February, 1971

The Way Your Cheque Gets Back Home, March, 1971

If a Computer Fouls Up Your Charge Account, January, 1971

Pamphlets - The American Standard Vocabulary for Information Processing;
American Standards Association; 10 East - 40th Street;
New York, N. Y. 10016

- N.C.R. Dayton, Ohio

History of Accounting

Electronic Data Processing Written for the Layman --

Book 1: What is Data Processing?

Book 2: What is Binary Arithmetic?

Book 3: What is a Computer?

Reference manuals for the various machines - I.B.M.

FORTTRAN IV: A Programmed Text (6 pamphlets) - Honeywell

You and the Computer - Canadian General Electric

Principles of Automatic Data Processing - Data Processing Management Association

The ABC's of Automatic Data Processing - Data Processing Management Association

D. Periodicals

Journal of Data Management; 404 N. Wesley Avenue, Mount Morris, Illinois 61054

Canadian Data Systems, A McLean-Hunter Publication, 481 University Ave., Toronto M5W 1A7, Ontario

Data Management, Data Processing Management Association, 505 Russe Highway, Park Ridge, Illinois 60068

Infosystems, Hitchcock Publishing Company, Hitchcock Building, Wheaton, Illinois 60187

Datamation, Technical Publishing Company, P. O. Box 2000, Greenwich, Ct. 06830

SABE Journal of Data Education, SABE Press, San Diego State College, San Diego, California 92115

E. Others

Business skills - MEETA television series of seven programs, 15 minutes each. These programs demonstrate the various unit record machine functions.

Here Come the 70's - This program often deals with the impact of the computer on Society.

Digi - Comp Digital Computer - A model digital computer that shifts, counts, compares, sequences and plays games. Available from Berkley Scientific Co. Ltd.; 540 Yonge Street; Toronto, Ontario; \$11.95.

Programmed Instruction Courses available from both I.B.M. & Honeywell.

Professional Data Processing Associations:

1. Data Processing Management Association (DPMA)

Mr. T. A. Hurle
Box 116
Station F
TORONTO, Ontario

2. Canadian Information Processing Society (CIPS)

R. Angus & Company
P. O. Box 2405
Postal Station F
EDMONTON, Alberta

IX. CLASSROOM FACILITIES AND EQUIPMENT

Data Processing and Computing Science classes can be taught in a regular classroom. No equipment is required to provide instruction in Data Processing 20; however, if electronic or mechanical equipment is available it can be used to enrich the course content.

Schools which plan to offer Computing Science 30 should be equipped with a sufficient number of Key-punch units, e.g. I.B.M. 029A22. One unit should meet the needs of approximately 20 to 25 students. Most of the data centers use the punch card as a basic medium of information processing but there are other means. Schools should acquire equipment that is compatible with the system that is used at the data center where student programs are processed. Schools may also choose to purchase or rent terminals and arrange for direct line communication with a data centre.

Computer time must be available for instructional purposes in Computing Science 30.

X. INTRODUCTION TO BUSINESS MACHINES

Machines are an integral part of modern business and every employee should have a fundamental knowledge of their use. Business Machines 30 is an important part of the business education program; an invaluable course for students in accounting, clerical, secretarial, and data processing patterns. It is also an excellent elective for all high school students since business machines touch so many different career areas.

It is inevitable that, in time, all calculating machines will be either electronic or mechanical printing units. The one feature that all these machines have in common is that they have only ten numeral keys and are operated by touch.

Emphasis in Business Machines 30 is placed on the following calculators; ten-key adding listing, ten-key printing, ten-key electronic. Schools that have full-key adding listing, rotary, and key-driven calculators may use these machines for enrichment during the transition to the ten-key units.

Schools may also supplement the Business Machines 30 course with the following units; if they are available; bookkeeping and billing machines, common types of duplicating machines, and dictating and transcribing machines.

Business Machines 30 is a five-credit course and has no prerequisite.

XI. GENERAL OBJECTIVES OF BUSINESS MACHINES

1. To familiarize the student with business machines - their operating features, advantages, and their practical uses.
2. To make the student aware of the important role that machines play in the processing of data in the business world.
3. To provide a vehicle for developing further the thought processes of problem analysis and problem-solving.
4. To help the student achieve competence in the operation of business machines in practical situations.
5. To enable students to secure an understanding of the values, attitudes, and ethics needed for success in business.

XII. BUSINESS MACHINES 30 (5 credits)

- A. Scope - Coverage of the course outline with emphasis on calculating machines.
- B. Primary References - Appropriate references are to be chosen from the following:
Business Machine Operations and Applications by Dool, McGraw-Hill Ryerson Limited, Scarborough, Ontario, 1973.
- OR *How to Use Adding and Calculating Machines:* by Walker et al
(3rd edition) McGraw-Hill Ryerson Ltd.
Scarborough, Ontario, 1967.
- OR *Office Machines Course;* Agnew et al (3rd edition) Gage Educational Publishing Co., Agincourt, Ontario, 1962.
- OR *Machine Calculations:* English et al, Pitman Publishing Co. Toronto.

C. Business Machines 30 - Course Outline

Specific ObjectivesSuggested Activities

The student should be able to:

1. Demonstrate proficiency in the touch operation of ten-key calculators.
 - a. continuous skill building using the step by step method of introducing new material.
 - b. practice in using new techniques.
 - c. review of the principles presented in each unit of instruction.
2. Add columns of figures at a speed of not less than 80 strokes per minute.
 - a. warmup review drills
 - b. frequent use of drills, beginning with two and three figure columns but gradually increasing in difficulty.
 - c. timed drills in which both speed and accuracy determine the net speed.
 - d. visual verification of printed tapes.
3. Add, subtract, multiply and divide using the prescribed method for the machine being used.
 - a. review of mathematical principles when introducing new material.
 - b. use of instructional models to demonstrate correct step by step procedures.
 - c. demonstration on calculators by instructor.
 - d. use flowcharting to demonstrate the procedure in solving problems using the various types of calculators.
 - e. use of drills to assure comprehension of methods.

4. Use the techniques learned to complete accurately, realistic business problems.
 - a. extend or audit invoices
 - b. calculate cash, trade and chain discounts.
 - c. complete or audit sales reports.
 - d. calculate proration of expenses.
 - e. compute discounts and determine the net amount.
 - f. compute percentages - increases and decreases.
 - g. make payroll calculations, regular, over-time and net pay.
 - h. compute markup, markdown and commission.
 - i. compute simple and compound interest.
 - j. prepare profit and loss statements.
 - k. compute board feet.
 - l. compute depreciation-monthly and annual.
 - m. compute real estate taxes (mill rate).
 - n. do verification of deposit slips.
 - o. check inventory.
5. Demonstrate the attitudes and work habits required in business.
 - a. make use of deadlines for completion of class assignments

e. g.

 - a. regular attendance
 - b. cooperation and participation in class.
 - c. neatness and accuracy

D. Evaluation

Behavioural objectives expressed in measurable or observable terms have been developed. Teachers may develop them much further. Evaluation procedures should recognize the fact that some students may relatively experience more growth in knowledge, skills and attitudes than others.

In assigning evaluation scores consideration should be given to the individual's progress (change) as well as to his demonstration of a reasonable standard of achievement. The following suggested chart for evaluating additional activities is included to serve as a guide only. This chart has been developed by practicing teachers. Business machines teachers should feel free to make modifications in terms of school and class needs and expectations.

SUGGESTED EVALUATION CHART FOR ADDITION ACTIVITIES

Adding--not strokes per minute on 4--minute timings.

(Columns containing 50 digits)

| MARK | TEN KEY | PRINTING CALC. | ROTARY CALC. | KEY DRIVEN CALC. | FULL KEY |
|------|----------|----------------|--------------|------------------|----------|
| 95 | over 135 | over 130 | over 95 | over 150 | over 100 |
| 90 | 130-134 | 125-129 | 90-94 | 145-149 | 95-99 |
| 85 | 125-129 | 120-124 | 85-89 | 140-144 | 90-94 |
| 80 | 120-124 | 115-119 | 80-84 | 135-139 | 85-89 |
| 75 | 115-119 | 110-114 | 75-79 | 130-134 | 80-84 |
| 70 | 110-114 | 105-109 | 70-74 | 125-129 | 75-79 |
| 65 | 105-109 | 100-104 | 65-69 | 120-124 | 70-74 |
| 60 | 100-104 | 95-99 | 60-64 | 115-119 | 65-69 |
| 55 | 95-99 | 90-94 | 55-59 | 110-114 | 60-64 |
| 50 | 90-94 | 85-89 | 50-54 | 105-109 | 55-59 |
| 45 | 85-89 | 80-84 | 45-49 | 100-104 | 50-54 |
| 40 | 80-84 | 75-79 | 40-44 | 95-99 | 45-49 |
| 35 | 75-79 | 70-74 | 35-39 | 90-94 | 40-44 |
| 30 | Below 75 | Below 70 | Below 35 | Below 90 | Below 40 |

Count the total digits entered, and record this number. Check your tape for errors and circle any incorrect digits. Subtract total errors from total digits entered to determine total correct digits entered. Divide total correct digits by length of timing to determine the correct digits entered per minute.

XIII. CLASSROOM FACILITIES AND EQUIPMENT

The business machines room should be equipped with the following basic furniture, fixtures and equipment.

- Teacher's desk and chair
- Students' desks with a flat top for writing, preferably 30-inches in height, and with a machine location top, approximately 27 inches high.
- Adjustable posture chairs
- Calculator on each desk. The three 10-key units; adding-listing printing calculators and electronic calculators should be available in the 1: 1: 1 ratio. Printing electronic calculators are more suitable for instructional purposes than the visual models. It is important that students learn procedures used in solving problems and this aspect is lost in a visual model.
- Filing cabinet(s) and storage space
- Chalkboard and bulletin boards
- Interval timer
- Stop watch
- Paper punch
- Stapler
- Desk trays
- Electric outlets (floor and wall)

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DATA PROCESSING 20 COMPUTING
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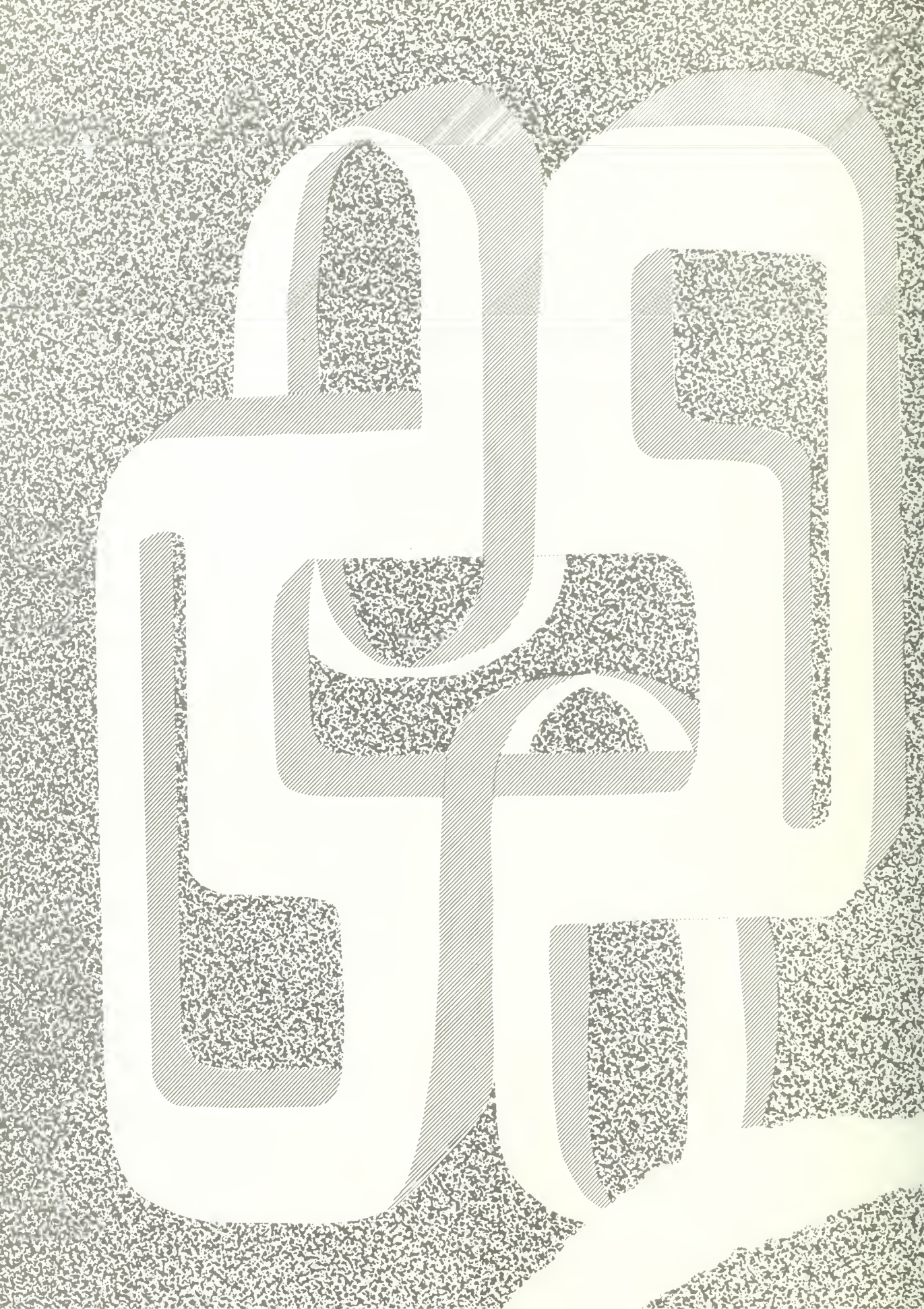
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CUSTOMER PAGE

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